15 August 2013
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JOMU/General

Memorandum

To: **Tom Leatherman, Superintendent, John Muir National Historic Site**

From: **Marie Denn, Aquatic Ecologist, NPS Pacific West Region**
Fernando Villalba, Natural Resources Specialist, John Muir National Historic Site

Subject: **Monitoring Alhambra Creek Morphology at Muir/Strentzel Gravesite**

This memo describes ongoing monitoring and assessment of channel stability of Alhambra Creek in the vicinity of the John Muir gravesite.

I. Problem Summary and Background

John Muir's grave is protected by the National Park Service (NPS) as part of the John Muir National Historic Site (JOMU). Muir, along with some of his immediate family and in-laws, is buried in the Muir/Strentzel Gravesite, which includes a 20' by 30' iron-fenced family graveyard along the northwestern bank of Alhambra Creek in Martinez, CA. The graveyard sits on a 1.27-acre parcel acquired by the NPS in 2000, originally part of the fruit ranch once managed by Muir and by his father in-law, Dr. John Strentzel, before him. The site still supports a historic orchard of pear trees planted by the family; however the graveyard and orchard are now surrounded by a suburban residential community of single family homes on 1-acre lots.

The single-thread Alhambra Creek, which forms the southeast boundary of the NPS-owned parcel, is entrenched through the gravesite parcel. The low-gradient creek (less than 2% slope) has a low width/depth ratio, low to moderate sinuosity, and native bed material of erodible silt and clay. The channel bed has been augmented with concrete blocks, presumably placed by local landowners in attempts to retard downward erosion of the bed. The riparian forest – consisting of mature sycamore *(Platinus racemosa)*, bay laurel *(Umbellularia californica)*, eucalyptus *(Eucalyptus* sp.*)*, and ponderosa pine *(Pinus ponderosa)* with an understory consisting of California blackberry (*Rubus ursinus*), English ivy (*Hedera helix*) and poison oak (*Toxicodendron diversilobum*)– stabilizes the upper elevations of the banks. Within the channel itself perennial wetland vegetation (*Juncus* sp., *Schoenoplectus* sp.) is establishing on newly-deposited sediment. The overall condition of the creek is a departure from its expected natural morphology, which would be less gullied and with higher sinuosity. The creek's entrenchment is likely due to increased surface water runoff speed caused by impervious surfaces associated with the low-density residential development (*i.e.*, rainwater runs quickly off pavement and roofs rather than infiltrating into the soil).

In 2001 and 2002 NPS hydrologist Rich Inglis visited the site to assess the creek's condition. He noted that the nearest corner of the graveyard sits about 35 feet northwest from the top of bank and that the channel bed lies 6 feet below the elevation of the graveyard. Inglis documented the evidence of ongoing creek bed incision: a narrow channel with oversteepened banks and a lack of bedrock control (comprehensively described in NPS 2002). Inglis and JOMU staff conducted a complete survey of trees at the site; Inglis noted that in some places the creek had eroded below the root zone of the bank-stabilizing riparian forest.

Inglis's observations caused concern about the potential for the graveyard to be eroded out of the bank by further deepening and widening of Alhambra Creek. Inglis recommended that the NPS continue to monitor the site for channel and vegetation changes, as well as consider installation of engineered bank protection and channel bed revetment (NPS 2002, NPS 2003, NPS 2004). Inglis also recommended installation of an elevational bed control structure just downstream of the gravesite to arrest channel downcutting, at least locally. This was accomplished in 2004 during the joint NPS/Contra Costa County Strentzel Lane Stormwater Drainage Project.

In 2005 NPS Hydrogeomorphologist Paul Kennard and NPS Ecologists Marie Denn and Susan O'Neil revisited the property to assess potential risks to the gravesite (NPS 2005). Kennard's assessment suggested that the graveyard was not at immediate risk of erosion due to (1) its location on an inside bend of the creek, and (2) a large mass-wasting site downstream of the NPS property which contributes sand to the creek and keeps the bed level high. However, neighboring landowners appeared to be continuing to install illegal revetment. Denn and O'Neil then surveyed the creek at two cross-sections immediately upstream of the gravesite (NPS 2005). Because Inglis had not permanently monumented his three survey locations, Denn and O'Neill could not resurvey the channel in the same locations as his original transects.

II. 2013 Channel Survey

In 2013 JOMU administrators requested a reassessment of the stability of Alhambra Creek adjacent to the Strentzel/Muir Gravesite. In May, Denn and JOMU Natural Resources Specialist Fernando Villalba visited the site to re-survey the two cross-sections read in 2005 and evaluate the status of the riparian vegetation and bed erosion. Denn and Villalba located the two 2005 monuments marking the endpoints of the cross-sections and measured the elevational morphology of the channel with a tripod-mounted survey-grade automatic level (Topcon ATG), a five meter graduated stadia rod, and a three hundred meter tape measure. Locations of the 2005 monuments are described inNPS 2005, survey methodology follows Harrelson et al. 1994. Neighboring landowners across the creek from the gravesite parcel have declined to allow the NPS to survey on their land after being formally notified that the assessment was taking place. Therefore, the 2013 surveys include the NPS-owned land only – from the monuments on the northern bank to the creek thalweg (*i.e.,* the property boundary). A comparison of the two surveys, 2005 and 2013, are shown in Figures 1 and 2 below.

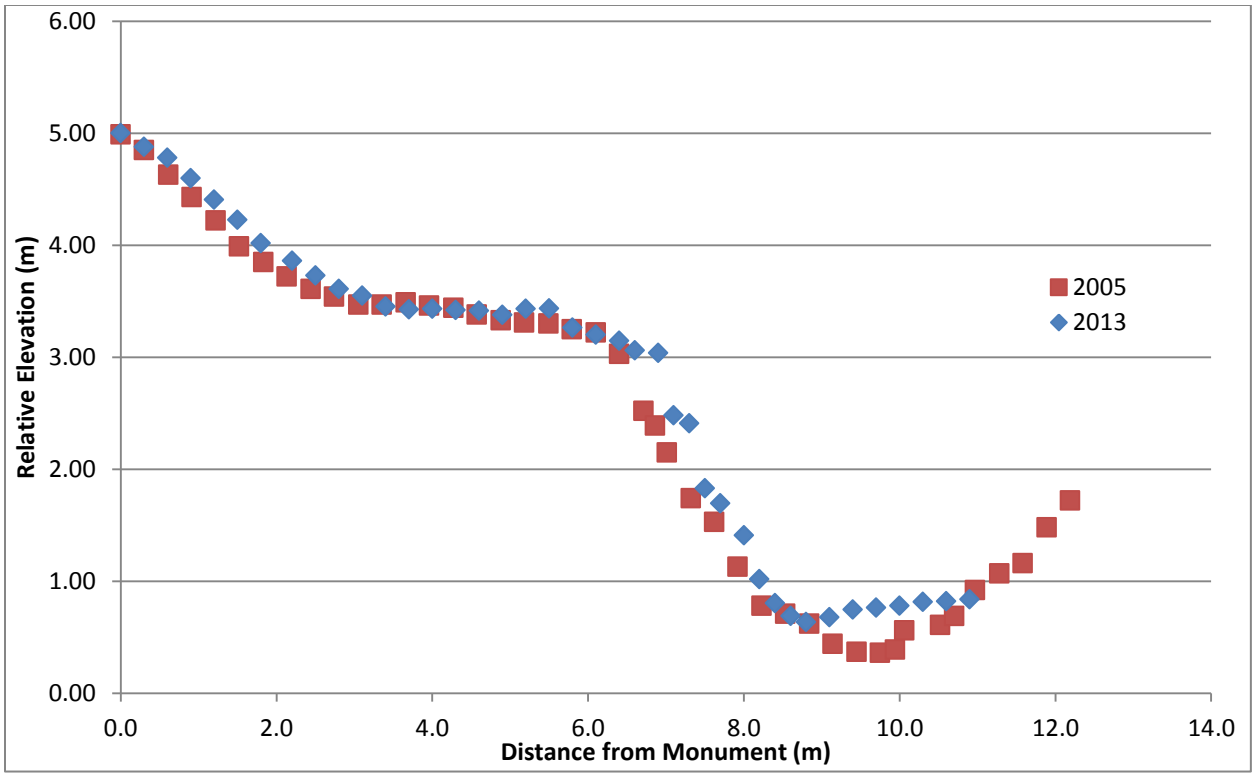

Figure 1: Cross-section 1 (upstream)

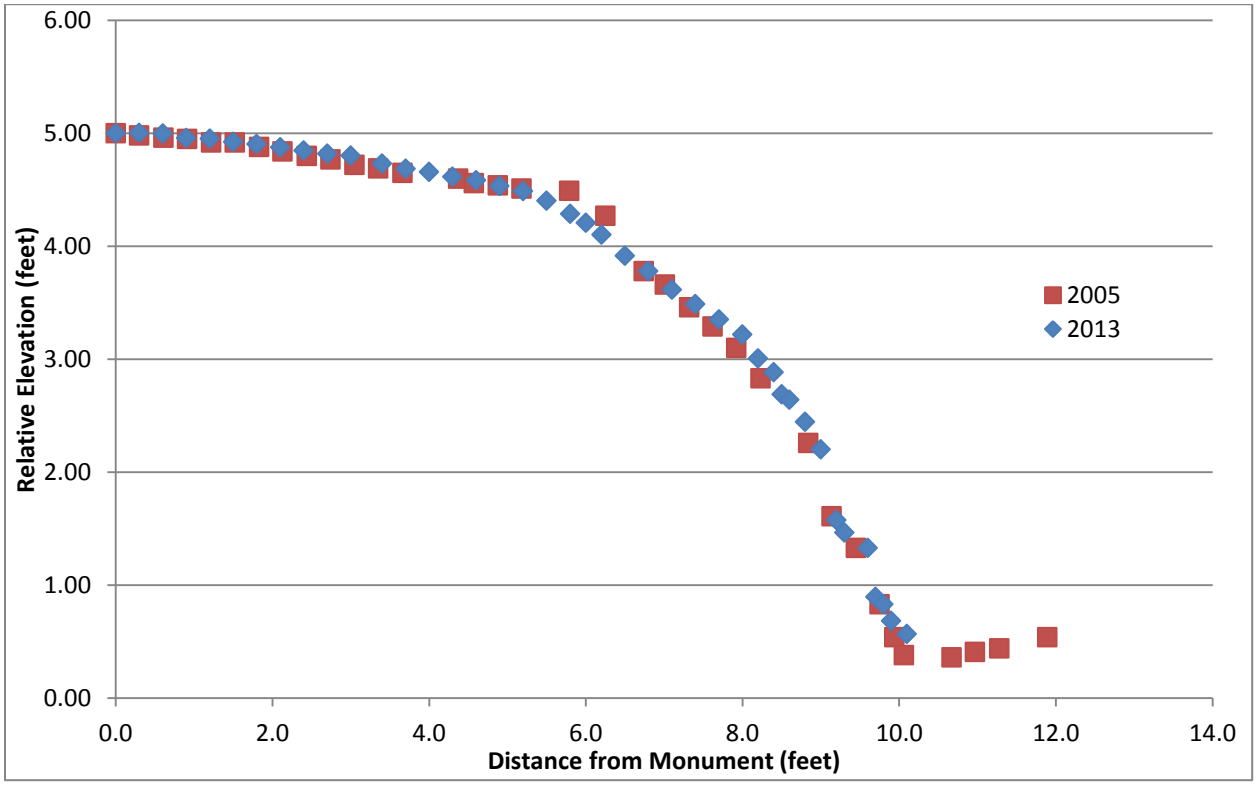

Figure 2: Cross-section 2 (downstream)

III. Conclusions and Recommendations

Based on re-measurement of the two 2005 cross-sections and observations of the site in both 2005 and 2013, these are primary conclusions about the stability of Alhambra Creek adjacent to the gravesite:

- Figures 1 and 2, above, chart results of the 2005 and 2013 surveys. The 2013 surveys did not span the entire channel, due to lack of permission to survey the bank opposite the NPS property. During post-survey analysis, datasets from the two surveys were aligned as best as possible, however the lack of end-point monuments on the far side of the creek slightly limits the utility of the data.

- The figures show that the channel did not move appreciably between 2005 and 2013. The channel has not deepened or cut into the bank of the NPS-owned property. If anything, the 2013 survey suggests aggradation of the channel at cross-section 1.

- Observed in 2013 but not in 2005: immediately adjacent to the gravesite, the creek is accumulating coarse sediment behind concrete blocks on the channel bed. The new sediment mounds are supporting herbaceous perennial wetland plants. This aggradation may be associated with the grade control structure installed just downstream of the gravesite in 2004 as a part of the Strentzel Lane Stormwater Drainage Project. The plants and the new sediment may be scoured out during a large winter storm and park staff may wish to inspect the channel after particularly large winter storms to look for potentially-destabilizing scour. However, at present the channel appears to be aggrading rather than eroding through the entire reach bordering the NPS property.

- The mature trees (predominantly sycamore and bay laurel) growing in the banks at and upstream of the graveyard appear healthy and have not changed appreciably between 2005 and 2013. However, the largest of these trees could destablize the bank and channel if they failed. The park horticulturist could inspect these once a year, ideally before the beginning of the storm season. If/when any of these trees die, park management should consider cutting the stump near the ground in order to prevent the tree from falling over and dislodging the roots. The park horticulturalist may recommend replacement of the dead tree with native riparian vegetation if the absence of the dead tree may leave a portion of the bank without rood structure in the future.

- In the past NPS staff have discussed enhancing the riparian forest in order to help stabilize the bank. However the vegetation on the NPS banks at the gravesite is in good condition, with a canopy well filled out with mature native trees. Laying the bank back and replanting the riparian forest may be counterproductive. There is an understory of the invasive vine *Vinca* below the tree canopy, but this can be treated locally without having an impact on channel stability if it's a park priority.

- Channelization of Alhambra Creek in the area around the gravesite is a long-term problem that the NPS can't improve by through isolated treatment of the bank abutting government property. Neighboring landowners are aware of the problem as many of their houses are built very near the current top-of-bank and very difficult given the limited space between the creek and the graveyard. Through a self-organized collaborative – the Alhambra Valley Creek Coalition in partnership with Friends of Alhambra Creek and Alhambra Watershed Council – some of landowners are attempting to bolster support to implement a channel stabilization project, possibly combining hard and soft engineering, for a 1-mile section of Alhambra Creek (with the gravesite reach approximately in the middle of that mile). However, the group hasn't yet been able to rally the funds needed to get the project beyond initial concept.

- An active channel hardening project at the NPS property – which would likely consist of laying back the bank toward the gravesite, installing limited engineered revetment, and revegetating the banks aggressively with young riparian trees – appears unnecessary and needlessly destabilizing at this time. Also, any project of this magnitude would need to factor in what is occurring just upstream and downstream of the creek in order to address and mitigate any potential negative impacts to adjacent properties. This conclusion should be reassessed annually based on continued observation of the channel conditions and mature riparian trees on the bank.

IV. Cited Documents

Harrelson, Cheryl C; Rawlins, C. L.; Potyondy, John P., 1994. Stream channel reference sites: an illustrated guide to field technique. Gen. Tech. Rep. RM-245. U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO. Available at http://stream.fs.fed.us/publications/PDFs/RM245E.PDF

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National Park Service, 2004. *Trip Report for Travel to Golden Gate National Recreation Area (GOGA), Point Reyes National Seashore (PORE), John Muir NHS and the Presidio of San Francisco, March 29-April 2, 2004.* Memorandum prepared by Joel Wagner, Wetland Program Lead, and Richard Inglis, Hydrologist, National Park Service Water Resources Division. Fort Collins, CO. Memorandum on file at National Park Service, Water Resources Division. 15 pp.

National Park Service, 2005. *Monitoring Alhambra Creek Morphology at Muir Gravesite.* Memorandum prepared by Marie Denn, Aquatic Ecologist, NPS Pacific West Region and Susan O'Neil, Natural Resources Specialist, San Francisco Bay Area Network of National Parks. Memorandum on file at Point Reyes National Seashore. 13 pp.

Appendix A: Creek morphology field data

See NPS 2005 for methodology and locations of cross-section endpoints.

Cross-section 1 (in meters)					**Cross-section 2 (in meters)**			
2013		**2005**			**2013**		**2005**	
Distance	Elevation	Distance	Elevation		Distance	Elevation	Distance	Elevation
0.0	5.00	0.0	5.00		0.0	5.00	0.0	5.00
0.3	4.88	0.3	4.99		0.3	5.00	0.3	4.98
0.6	4.78	0.6	4.85		0.6	5.00	0.6	4.96
0.9	4.60	0.9	4.63		0.9	4.96	0.9	4.95
1.2	4.41	1.2	4.43		1.2	4.95	1.2	4.92
1.5	4.23	1.5	4.22		1.5	4.92	1.5	4.92
1.8	4.02	1.8	3.99		1.8	4.91	1.8	4.88
2.2	3.86	2.1	3.85		2.1	4.88	2.1	4.84
2.5	3.73	2.4	3.72		2.4	4.85	2.4	4.80
2.8	3.61	2.7	3.61		2.7	4.82	2.7	4.77
3.1	3.55	3.1	3.54		3.0	4.80	3.1	4.72
3.4	3.45	3.4	3.47		3.4	4.73	3.4	4.69
3.7	3.43	3.7	3.47		3.7	4.69	3.7	4.65
4.0	3.43	4.0	3.49		4.0	4.66	4.4	4.60
4.3	3.42	4.3	3.46		4.3	4.62	4.6	4.56
4.6	3.42	4.6	3.44		4.6	4.59	4.9	4.54
4.9	3.38	4.9	3.38		4.9	4.53	5.2	4.51
5.2	3.43	5.2	3.33		5.2	4.49	5.8	4.49
5.5	3.44	5.5	3.31		5.5	4.40	6.3	4.27
5.8	3.26	5.8	3.30		5.8	4.29	6.7	3.78
6.1	3.20	6.1	3.25		6.0	4.21	7.0	3.66
6.4	3.15	6.4	3.22		6.2	4.10	7.3	3.46
6.6	3.06	6.7	3.03		6.5	3.91	7.6	3.29
6.9	3.04	6.9	2.52		6.8	3.78	7.9	3.10
7.1	2.48	7.0	2.39		7.1	3.62	8.2	2.83
7.3	2.41	7.3	2.15		7.4	3.49	8.8	2.26
7.5	1.83	7.6	1.74		7.7	3.35	9.1	1.61
7.7	1.70	7.9	1.53		8.0	3.22	9.5	1.33
8.0	1.41	8.2	1.13		8.2	3.01	9.8	0.83
8.2	1.02	8.5	0.78		8.4	2.88	9.9	0.54
8.4	0.80	8.8	0.71		8.5	2.69	10.1	0.38
8.6	0.69	9.1	0.62		8.6	2.64	10.7	0.36
8.8	0.64	9.5	0.44		8.8	2.45	11.0	0.41
9.1	0.68	9.8	0.37		9.0	2.20	11.3	0.44
9.4	0.75	9.9	0.36		9.2	1.58	11.9	0.54
9.7	0.76	10.1	0.39		9.3	1.46	12.2	0.56
10.0	0.78	10.5	0.56		9.6	1.33	12.5	0.61
10.3	0.82	10.7	0.61		9.7	0.90	13.1	0.84
10.6	0.82	11.0	0.69		9.8	0.83	13.4	0.99
10.9	0.84	11.3	0.92		9.9	0.68	13.7	1.11
		11.6	1.07		10.1	0.57	14.0	1.25
		11.9	1.16				14.3	1.52
		12.2	1.48				14.6	1.97
		12.5	1.72				14.9	2.17
		12.8	1.92				15.2	2.59
		13.1	1.99				15.5	2.82
		13.4	2.20				15.9	3.31
		13.7	2.40				16.2	3.69
		14.0	2.67				16.5	3.81
							16.8	4.20
							17.1	4.42

National Park Service, 2005. *Monitoring Alhambra Creek Morphology at Muir Gravesite.* Memorandum prepared by Marie Denn, Aquatic Ecologist, NPS Pacific West Region and Susan O'Neil, Natural Resources Specialist, San Francisco Bay Area Network of National Parks. Memorandum on file at Point Reyes National Seashore. 13 pp.